

That there is a causal relationship, based upon human case finding, animal testing, biochemistry, and structure-activity relationships, is precisely the point. This has also been demonstrated by additional independent physicians and scientists and appears in various publications and court records.

The cost of caring for one of these totally dependent children is in excess of \$500,000. The financial, emotional, social, and physical burdens upon the families is staggering. Prevention is imperative.

**Janette D. Sherman**  
Alexandria, Virginia

#### REFERENCES AND NOTES

- Guillette EA, Meza MM, Aquilar MG, Soto AD, Garcia IE. An anthropological approach to the evaluation of preschool children exposed to pesticides in Mexico. *Environ Health Perspect* 106:347-353 (1998).
- Garry VF, Schreinemachers D, Harkins ME, Griffith J. Pesticide applicators, biocides, and birth defects in rural Minnesota. *Environ Health Perspect* 104:394-399 (1996).
- Pogoda JM, Preston-Martin S. Household pesticides and risk of pediatric brain tumors. *Environ Health Perspect* 105:1214-1220 (1997).
- Gurunathan S, Robson M, Freeman N, Buckley B, Roy A, Meyer R, Bukowski J, Lioy PJ. Accumulation of chlorpyrifos on residential surfaces and toys accessible to children. *Environ Health Perspect* 106:9-16 (1998).
- Gibson JE, Peterson RKD, Shurdut BA. Human exposure and risk from indoor use of chlorpyrifos. *Environ Health Perspect* 106:303-306 (1998).
- Letter from LR Goldman, Assistant Administrator, Office of Prevention, Pesticides and Toxic Substances, U.S. EPA, to J Hagaman, President and CEO, DowElanco, 14 January 1997.
- Sherman JD. Reply to JPQ Maurissen's letter to the editor. *Toxicol Ind Health* 13(1):91-93,95-97 (1997).
- U.S. EPA memorandum from J Blondell and VA Bobozy, Health Effects Division, to L Propst, Special Review and Reregistration. Review of chlorpyrifos poisoning data, 14 January 1997.
- Jackson MA, Stark HF, Waters MD. Genetic Activity Profiles of Agents from the Long Island Breast Cancer Project. Research Triangle Park, NC:US Environmental Protection Agency, 1996.
- Garry VF, Tarone RE, Long L, Griffith J, Kelly JT, Burroughs B. Pesticide applicators with mixed pesticide exposure: G-banded analysis and possible relationship to non-Hodgkin's lymphoma. *Cancer Epidemiol Biomarkers Prev* 5:11-16 (1996).
- Reports are available from U.S. EPA Office of Pesticides Programs, Washington, DC, under a Freedom of Information (FOI) request. Cases are reported under a numbering system named "DERBI" (DowElanco Research Business Index). These include the following DERBI numbers: 9920; 23154; 23178; 23194; 23296; 23397; 23436; 23575; 23577; 28735; and 23415.
- Dow Chemical Co. Material Safety Data Sheet. Dow Dursban TC. Midland, MI:Dow Chemical Co., 1997.
- Dow Chemical Co. Material Safety Data Sheet. Trichloropyridinol. Midland, MI:Dow Chemical Co., 1991.
- Hanley TR Jr, Zielke GJ, Lomax LG. 3,5,6-Trichloro-2-pyridinol: Oral Teratology Study in New Zealand White Rabbits. Midland, MI:Dow Chemical Co., 1987.
- Goldsmith JR, Kordysh E, Sobel R, Avnon L, Oryan I. Birth defects associated with agricultural chemicals used in some cooperative agricultural settlements. Presented at the International Symposium on Environment, Lifestyle and Fertility, 12-13 December 1997, Aarhus, Denmark.
- Letter from JR Goldsmith to S Sullivan, U.S. EPA Office of Pesticides, 16 April 1997.
- Whitney KD, Seidler FJ, Slotkin TA. Developmental neurotoxicity of chlorpyrifos: cellular mechanisms. *Toxicol Appl Pharmacol* 134:53-62 (1995).
- Sherman JD. Chlorpyrifos (Dursban)-associated birth defects: report of four cases. *Arch Environ Health* 51(1):5-8 (1996).
- National Bank of Commerce et al. (Eldorado, AR) v. Dow Chemical Co., et al. Case No LR-C-94-64. U.S. District Court for the Eastern District of Arkansas, Little Rock, AR (testimony of JD Sherman), 12 September 1996:6-61.
- Sherman JD. Chlorpyrifos (Dursban)-associated birth defects: a proposed syndrome, report of four cases, and discussion of the toxicology. *Int J Occup Med Toxicol* 4(4):417-431 (1995).
- Sherman JD. Organophosphate pesticides—neurological and respiratory toxicity. *Toxicol Ind Health* 11(1):33-39 (1995).
- J Herb, V Herb, GF Herb v. Dow Chemical Co. et al. Civil Action No 90-C-2420, Circuit Court of Kanawha County, WV, Charleston, WV, 1990.
- Wargo J. Our Children's Toxic Legacy. New Haven, CT:Yale University Press, 1996.
- National Research Council. Pesticides in the Diets of Infants and Children. Washington, DC:National Academy Press, 1993.
- Sherman JD. Chemical Exposure and Disease: Diagnostic and Investigative Techniques. Princeton, NJ:Princeton Scientific Publishing, 1994.

#### Response to Sherman

We find it unnecessary to address all statements made by Janette Sherman in her letter about our article in the June issue of *EHP* (1). It is important to note that the Centers for Disease Control and Prevention (CDC), the U.S. EPA, and the California EPA have each reviewed Sherman's arguments and purported evidence and concluded that Sherman has failed to establish a legitimate association between human exposure to chlorpyrifos and teratogenicity. In a letter to Jerome Blondell of the U.S. EPA (2), the CDC commented on Sherman's evidence as follows:

At the present, there does not appear to be a consistent phenotypic pattern of anomalies among the infants whose records we reviewed. In addition, you reported that [chlorpyrifos] is used extensively in the United States. Based on the available medical records and the likely high frequency of this exposure, we would be hesitant to recommend pursuing major epidemiological studies at this point in time.

Subsequently, on 14 January 1997, Blondell issued a memorandum (3) which stated that

HED [the Health Effects Division of the EPA] concludes that available evidence does not support a finding of teratogenicity based on human epidemiology studies and case reports.

Similarly, in a memorandum dated 27 January 1997 (4), R. Cochran, staff toxicologist of the Medical Toxicology Branch of the Department of Pesticide Regulation of the California EPA stated

There was no scientific evidence presented in either paper by Dr. Sherman which supported the contention that chlorpyrifos could cause birth defects—either in laboratory animals or humans.

In addition to government scientists and regulators, two independent panels of scientific experts have comprehensively reviewed published chlorpyrifos toxicology and epidemiology studies, including Sherman's papers, and both have rejected the scientific validity of any claims associating chlorpyrifos exposure with birth defects (5,6).

We stand behind our paper in all respects, and we feel that any objective review of the relevant data will strongly support our conclusions.

**James E. Gibson**  
Dow AgroSciences LLC  
Indianapolis, Indiana

#### REFERENCES AND NOTES

- Gibson JE, Peterson RKD, Shurdut BA. Human exposure and risk from indoor use of chlorpyrifos. *Environ Health Perspect* 106:303-306 (1998).
- Letter to Jerome Blondell, U.S. Environmental Protection Agency, from JD Erickson, CA Moore, and HE Roberts, Centers for Disease Control and Prevention, 18 December 1996.
- Memorandum from J Blondell and VA Bobozy, Health Effects Division, U.S. Environmental Protection Agency, to L Propst, Special Review and Reregistration. Review of chlorpyrifos poisoning data, 14 January 1997.
- Memorandum from R Cochran, staff toxicologist, Health Assessment Section, Medical Toxicology Branch, Department of Pesticide Regulation, California Environmental Protection Agency, to G Peterson, supervising toxicologist, Medical Toxicology Branch, Department of Pesticide Regulation, California Environmental Protection Agency. Review of DowElanco Study No JEG122396: Critical review of allegations associating Dursban with human teratogenicity, 27 January 1997.
- Clegg DJ, van Gemert M. Determination of the reference dose for chlorpyrifos: proceedings of an expert panel. *J Toxicol Environ Health* (in press).
- Albers JW, Cole P, Greenberg RS, Mandel JS, Monson RR, Ross JH, Snoggrass WR, Spurgeon A, van Gemert M. Analysis of chlorpyrifos exposure and human health: expert panel report. *J Toxicol Environ Health* (in press).